B-jet soft-lepton tagging

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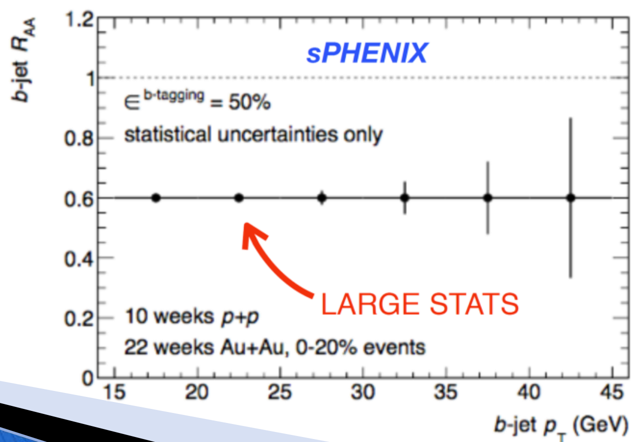
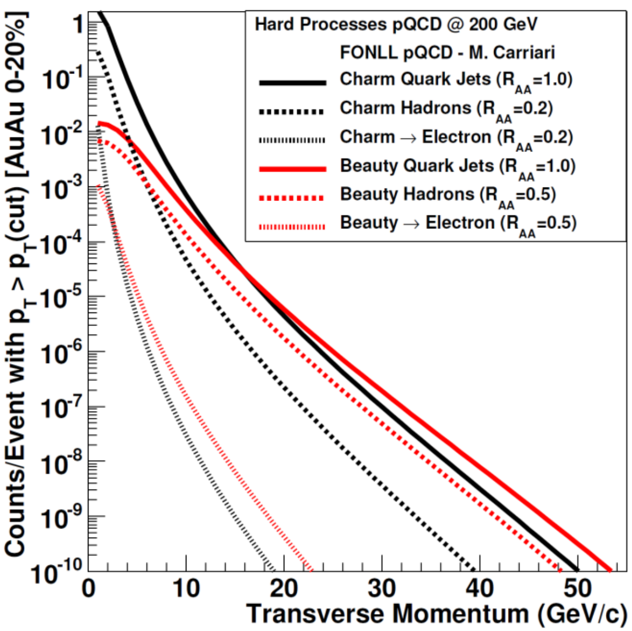
Introduction

- None-photonic lepton has been a successful tool in studying heavy quark behavior in QGP
- Given a jet detected, lepton tagging in or near the jet cone could enhance HF jet fraction due to larger fraction of B(->d)->e decay than h->e decays.
  - Benefit:
    - Not necessarily require a DCA capability. No additional sPHENIX detector required
    - (Largely) orthogonal to and cross check life-time-based B tagging: e.g. DCA-track-counting and Secondary vertex mass methods
  - Cost: B->e branching ratio (~20%), electron identification efficiency, (b-tagging efficiency)
- Challenge:
  - Exploring possibility @ RHIC energy
  - Signal/background ratio
  - Optimization both in $j_{T,e}$ and DCA_e
  - Statistics

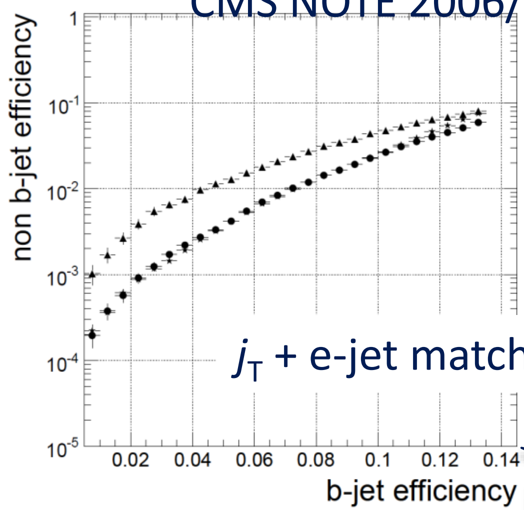




CMS studies (muon tagging)

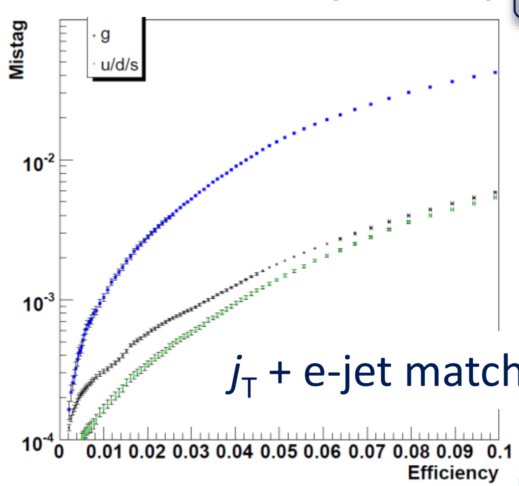
Rejection VS tagging eff.

CMS NOTE 2006/043



j_T + e-jet matching + DCA_e

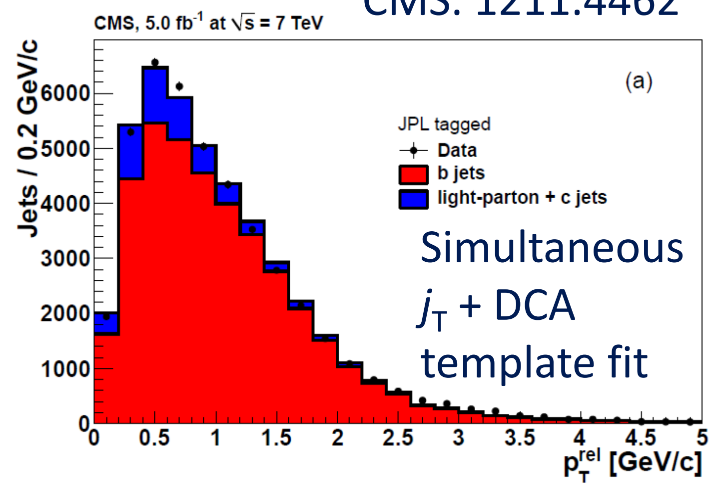
Suffer of B->μ BR



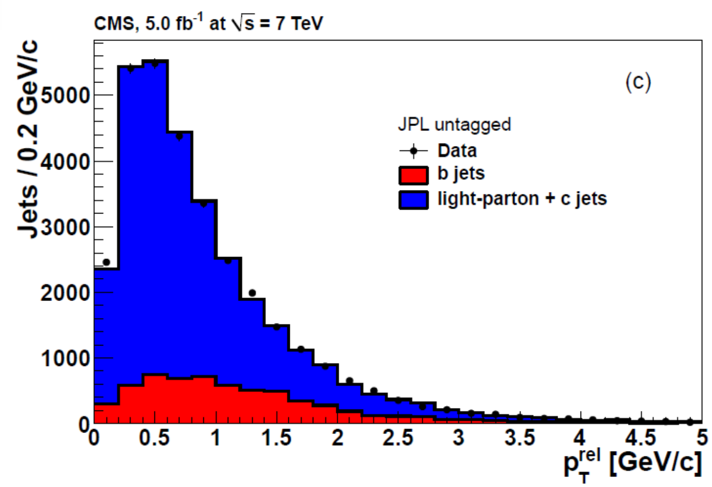
j_T + e-jet matching ~~no DCA_e~~

As cross check to JP/L method

CMS. 1211.4462



Simultaneous
j_T + DCA
template fit



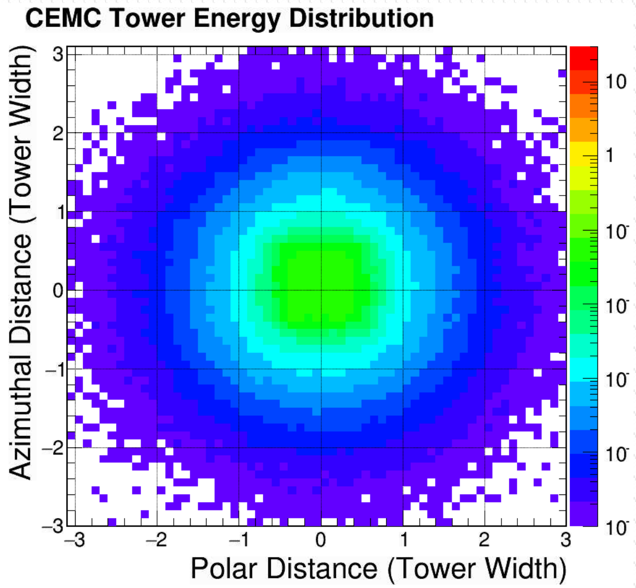
Electron ID

- Choice of electron leads to difference background than muons
- sPHENIX use EMCal + inner HCal to reject to
  - >100:1 in pp
  - ~100:1 in inclusive tracks in Central 10% AuAu
  - ??:1 for electron candidate near a jet <- TODOs
- One recent de-scoping option involves reduce scope of the EMCal
  - Reduce readout channel by ganging tower together for readout
  - Reduce tower count by cut eta coverages

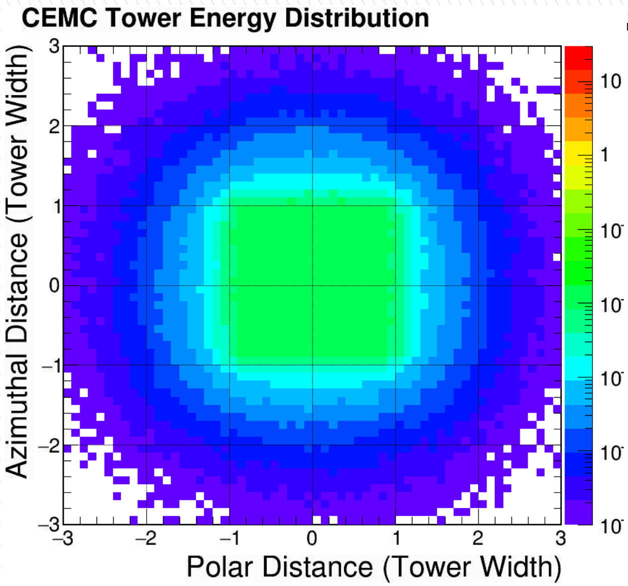
EM-Shower shape as observed in readout

8 GeV e- shower in 2D proj. SPACAL around eta = 0

Larger spread of shower core requires larger cluster to contain, which pickup higher portion of hadronic shower and higher event background

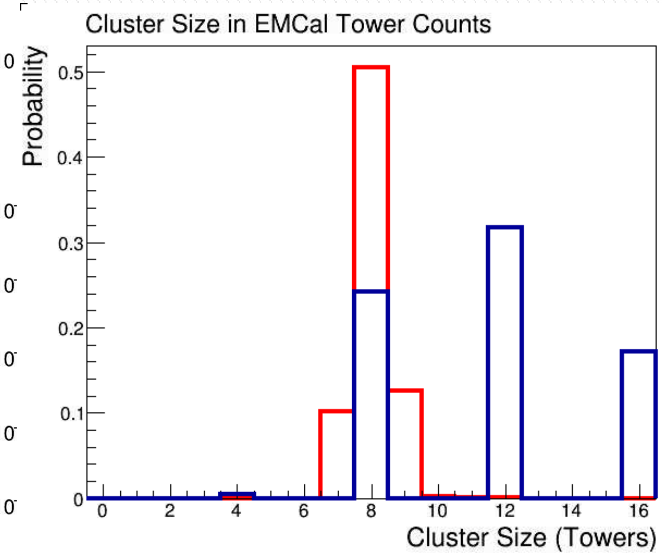


One readout per tower



One readout per 2x2 tower

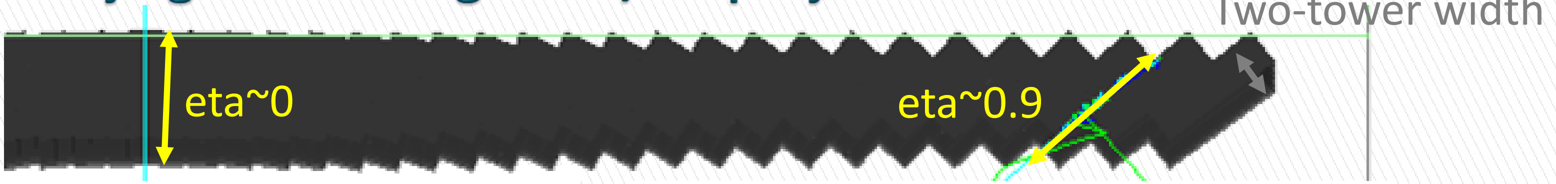
— Default
— 2x2 Ganging

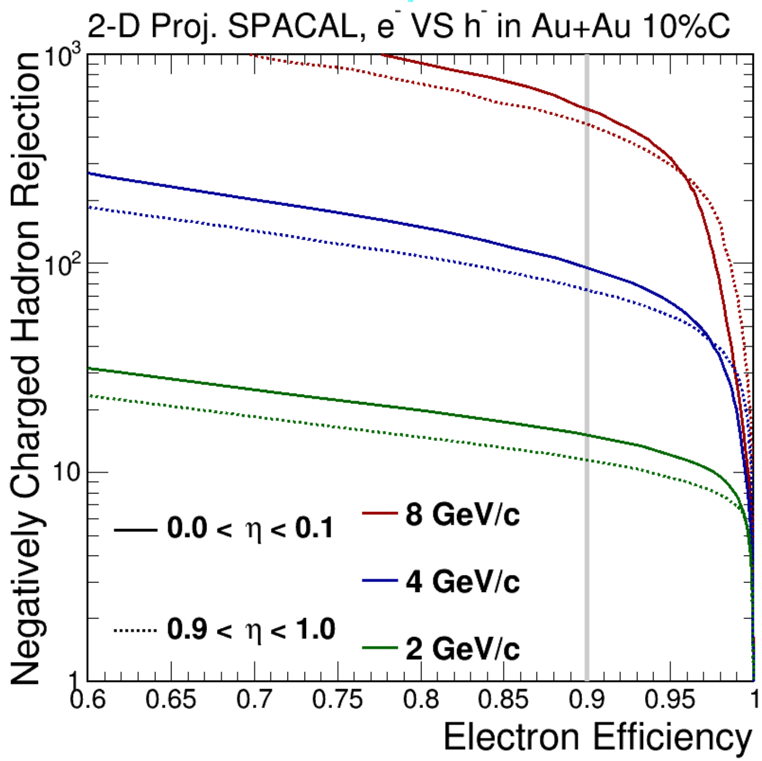


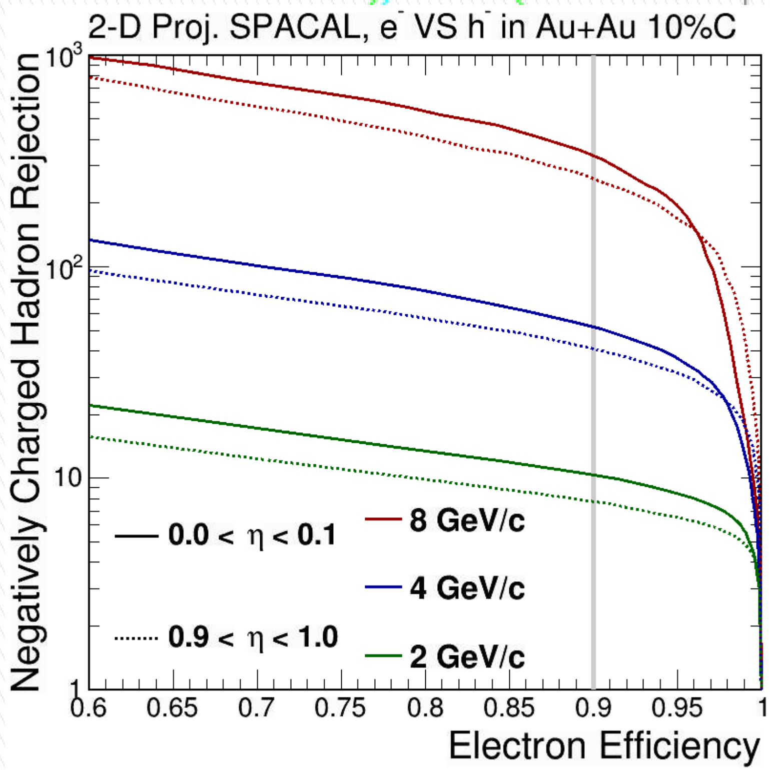
Cluster size comparison

In Hijing –2D SPACAL summary: h-

10% Central Hijing embedding in 1D/2D proj. SPACAL







One readout per tower

One readout per 2x2 tower
Cluster size x (1.2x1.2)

Work Plan

- First iteration: Pythia based B-jet finding eff. Rej. with ideal detector
- Second iteration: Introduce detector efficiency/purity and produce eff. Rejection curves
- Third iteration: Evaluate in Hijing, with background and FF modifications
- Help and suggestion welcomed!

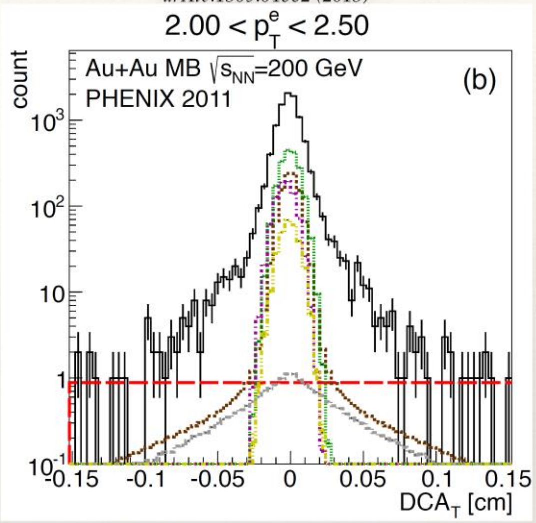
Extra information

PHENIX HF Electron data

DCA_T Data

- Measure DCA_T distribution of electrons from 2011 (Run 11) data set.
  - 5 electron p_T bins from $1.5 < p_T < 5.0$
  - no efficiency correction
- Determine normalized background contributions.

arXiv:1509.04662 (2015)



Mis-associated VTX Hits	Mis-identified hadron
Data Driven	Data Driven
Tracks with large DCA_L	RICH swap method

Prompt

Dalitz ($\eta, \pi \to e^+e^-\gamma$)	Conversion ($\gamma \to e^+e^-$)	$J/\psi \to e^+e^-$	Ke3 ($K_s^0 \to e\nu\pi$)
Measured yield	~75% rejected	Measured yield	Measured yield
Monte Carlo shape	Monte Carlo shape	Monte Carlo shape	Monte Carlo shape

See poster by **H. ASANO - 0504**

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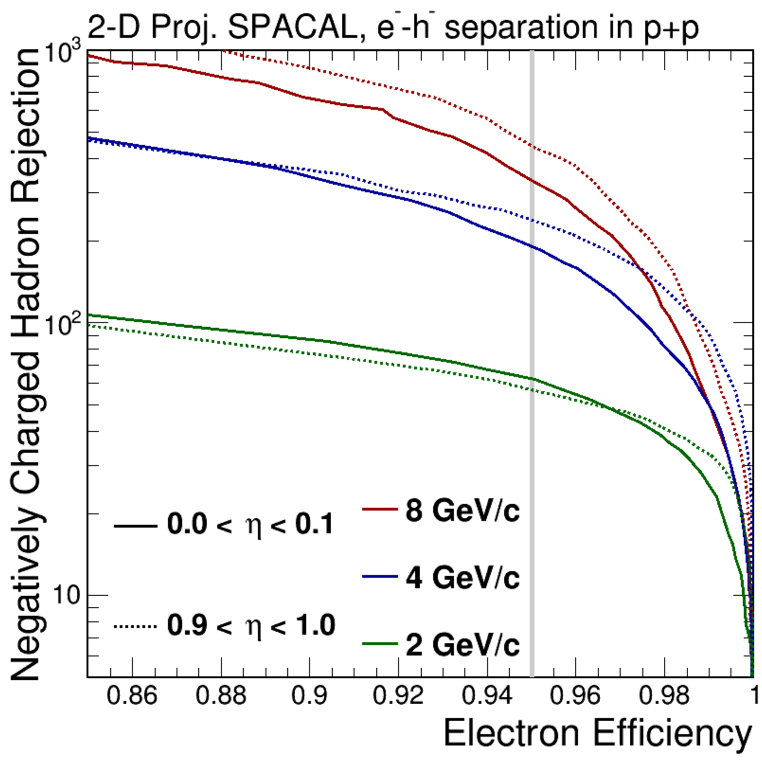
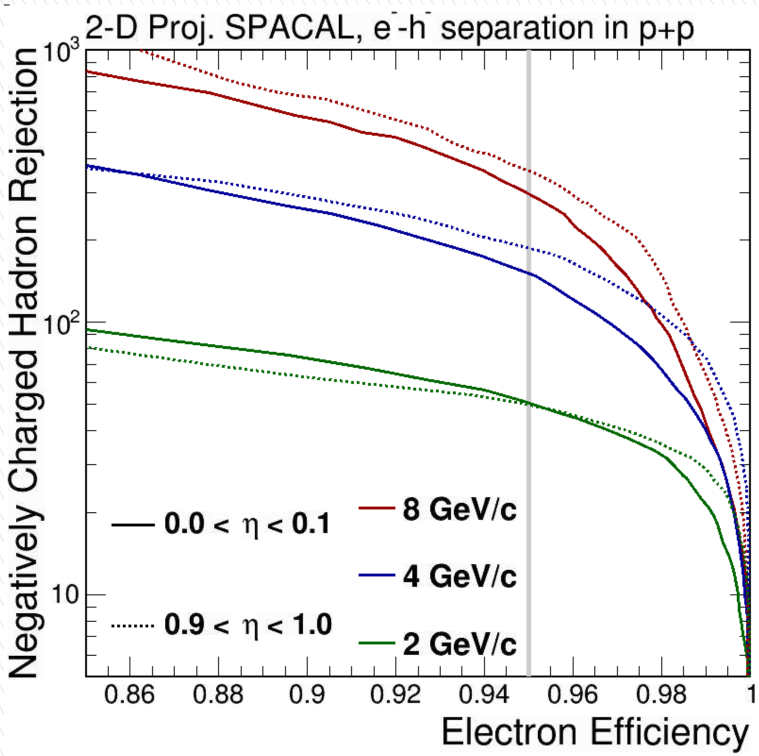
Single Particle Summary: h-

Single negatively charged particle 2/4/8 GeV shower in 2D proj. SPACAL





One readout per tower

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